D.8 Hydrology and Water Quality

This section considers the potential impacts of the SFPP proposed pipeline system on surface and groundwater hydrology and water quality. Section D.8.1 describes the environmental setting of the Proposed Project area, and Section D.8.2 describes the regulatory requirements relevant to water resources. Section D.8.3 details the environmental impacts and mitigation measures for the Proposed Project. Sections D.8.4 and D.8.5 describe impacts of alternatives.

D.8.1 Environmental Baseline

D.8.1.1 Regional Overview: Sacramento Valley and San Francisco Bay Region

Climate

Sacramento Valley. The Sacramento Valley is characterized by hot, dry summers and cold, wet winters with occasional foggy conditions. Summer average high temperatures range from approximately the mid to upper 90°F and winter average low temperatures range in the lower 40 °F.

Most of the precipitation in the form of rainfall occurs during the winter months and can be intense at times. Average annual precipitation recorded from 1971 through 2000 at the Sacramento and Davis stations was approximately 19.71 inches and 19.10 inches, respectively. The highest average total precipitation for this period at the Sacramento Station was recorded at 3.94 inches during the month of February. The highest monthly average at the Davis station recorded 4.03 inches during the month of January. Vacaville, which is located at the western most portion of the Sacramento Valley, recorded annual average precipitation from 1971 through 2000 at approximately 25.07 inches with the highest average monthly precipitation at 5.44 inches during the month of January (Western Regional Climate Center website 2003).

San Francisco Bay Region. The San Francisco Bay Region has mild, dry summers and cool, wet winters. Average annual high temperatures for the Martinez area of the pipeline route range in the lower 70°F with the warmest months from May through October. Average annual low temperatures range in the upper 40 °F with the coolest months from December through March. Temperatures for the Fairfield portion of the project are approximately the same as Martinez.

The Martinez and Fairfield areas of the San Francisco Bay Region experience most of the precipitation from October through April. The annual average precipitation recorded from 1950 through 2001 for Martinez and Fairfield is approximately 19.59 inches and 22.44 inches, respectively (Western Regional Climate Center website 2003).

Watershed Characteristics

Surface Water Hydrology

Sacramento Valley. A portion of the Proposed Project is located in the Sacramento River Basin. The drainage area within the basin is approximately 27,210 square miles and surface waters within this basin drain to the Sacramento River. The Sacramento River is the major watercourse within the basin and has an average flow of approximately 24,000 cubic feet per second (cfs) (County of Sacramento, 2001). Tributaries to the Sacramento River include the following: Pit, Feather, Yuba, Bear, and American Rivers to the east; and Cottonwood, Stony, Cache, and Putah Creeks to the west. The Proposed Project would traverse through a portion of the western drainage area of the Sacramento River and cross the South Fork of Putah Creek and the Yolo Bypass. The Bypass is a leveed, 59,000-acre floodplain on the west side of the Lower Sacramento River in Yolo and Solano Counties and was created to accommodate flood-waters from the Sacramento, American, and Feather Rivers. The overall design capacity of the Yolo Bypass is approximately 500,000 cfs (Yolo Basin Foundation, 2001). Major watercourses within the Proposed Project portion of the Bypass include the Willow Slough and the Toe Drain (Sacramento River).

San Francisco Bay Region. The Proposed Project will traverse through a portion of the Suisun Bay region of the San Francisco Bay. The Suisun Bay watershed consists of approximately 598.3 square miles (CERES, 2003). The major source of freshwater for the entire San Francisco bay, via the eastern portion of Suisun Bay, is delivered by the Sacramento and San Joaquin Rivers. The major watercourses that the Proposed Project would cross within the Suisun Bay watershed are the Walnut and Grayson Creeks, Pacheco Slough, Peyton Slough, Carquinez Strait, Cordelia Slough, Peytonia Slough, Sulphur Springs, Suisun, Ledgewood, and Laurel Creeks. Other drainage areas throughout the watershed consist of ephemeral drainages that experience flow during runoff events.

Surface Water Quality

Sacramento Valley. Water quality within the Sacramento Valley is primarily influenced by local land uses including but not limited to urban and agricultural operations. Urban runoff includes stormwater, irrigation water, and other nonpoint-source discharges. The contaminants associated with urban runoff include sediments, hydrocarbons and metals, bacteria, nutrients, pesticides, and trash. Most sources for urban runoff include disturbed areas under development, parking lots and roadways, and landscaped areas such as lawns and vegetated roadside areas. Agricultural runoff includes fertilizers, herbicides, pesticides, and sediment from irrigation return flows and precipitation events.

Primary uses of water throughout the Sacramento Valley are agricultural irrigation, domestic use, habitat, and industrial/commercial use.

The Central Valley Regional Water Quality Control Board (CVRWQCB), via Water Quality Control Plans (Basin Plans) for the Sacramento River Basin and San Joaquin River Basin, has established beneficial uses for the Sacramento River. Designation of beneficial uses defines the resources, services, and qualities of the aquatic system that are the ultimate goals of protecting and achieving good water quality. The CVRWQCB has designated water quality objectives for all surface waters within the region regarding bacteria, bioaccumulation, biostimulatory substances (promote adverse aquatic growth), color, dissolved oxygen, floating material, oil and grease, population and community ecology, pH, salinity, sediment, settleable material, suspended material, sulfide, tastes and odors, temperature, toxicity, turbidity, and ammonia (County of Sacramento, 2001).

San Francisco Bay Region. Surface water quality throughout the Suisun Bay watershed is influenced by urban, agricultural, and industrial activities. The San Francisco Regional Water Quality Control Board (SFRWQCB) has established water quality objectives for this watershed that are identical to those mentioned in the Sacramento River Basin along with the addition of salinity. The Suisun Bay is listed on the Clean Water Act Section 303(d) list of water quality–impaired waterbodies for the following pollutants/stressors: copper, mercury, nickel, selenium, exotics, chlordane, DDT, diazinon, dieldrin, dioxins, furans, and PCBs.

Groundwater

Sacramento Valley. A portion of the Proposed Project would extend through the Sacramento Valley Groundwater Basin, which represents the largest groundwater basin in northern California. The basin underlies a 5,000-square-mile area that includes portions of Butte, Colusa, Glenn, Placer, Sacramento, Solano, Sutter, Tehama, Yolo, and Yuba Counties. The storage capacity of this groundwater basin is approximately 113,650,000 acre-feet. Average and maximum well yields are approximately 800 and 4,000 gallons per minute (gpm), respectively (CPUC, 2002). Groundwater recharge within the Sacramento Valley Groundwater Basin is from precipitation, contributions from peripheral basins, and through percolation from surface waters (including irrigation waters) traversing through this basin.

Groundwater in the Sacramento Valley Groundwater Basin is used for irrigation and domestic uses: however some irrigated waters contain elevated levels of boron and some domestic waters contain elevated levels of nitrates and chlorides. The Basin Plans for the Sacramento River and San Joaquin River provide objectives and beneficial uses for groundwater quality. The listed water quality objectives include thresholds for the following: bacteria, organic and inorganic chemical constituents, radioactivity, and tastes and odors (County of Sacramento, 2001).

San Francisco Bay Region. The major groundwater basin in the project portion of the San Francisco Bay region is the Suisun-Fairfield Valley Groundwater Basin. This basin encompasses 203 square miles and has a storage capacity of approximately 40,000 acre-feet. No figure has been provided for average annual yield (SFRWQCB, 2003).

The Basin Plan for the San Francisco Bay Region designates beneficial uses for groundwater for Municipal and Domestic, Process Industrial Water, Industrial Service, Agricultural, and Freshwater Replenishment to Surface Water. Groundwater quality objectives for the Suisun-Fairfield Groundwater Basin are similar to the ones listed for the Sacramento Valley Groundwater Basin.

General Groundwater Characteristics. Groundwater throughout the entire pipeline length is shallow. Although there are local variations, the groundwater surface is at approximately elevation 0 msl throughout most of the area traversed by the pipeline (USGS, 1995). Since the ground surface at the location of the pipeline is generally less than 100 feet msl, the groundwater is generally less than 100 feet below the pipeline. From approximately milepost 16 near Cordelia to the pipeline terminus at Sacramento (approximately 54 miles and 75 percent of the pipeline route), ground elevations are generally less than 25 feet mean sea level (msl), meaning the distance between the pipeline and groundwater at 0 msl will be approximately 20 feet.

Groundwater along the pipeline route is used for domestic and municipal purposes and for agriculture. Groundwater use increases during dry years when surface water supplies are limited. Groundwater quality in the Central Valley north of the Carquinez Strait is generally good (USGS, 1995), although there are areas within Solano County of localized contamination by petroleum hydrocarbons, solvents, and metals (RWQCB, 2002).

D.8.1.2 Environmental Setting: Proposed Project

This section provides more detailed information on local surface waters and groundwater that could be affected by the proposed pipeline in each of the seven segments.

Segment 1 (MP 0–6.1) – Contra Costa County and Carquinez Strait

Segment 1 starts from the Concord Station and ends at the north side of the Carquinez Strait. There are four surface water crossings in this segment (see Table D.8-1), but the Carquinez Strait crossing would involve no new construction because the existing 14-inch pipeline would be used. The other three crossings are tidal waterways, under the jurisdiction of the CSLC.

Table D.8-1. Water Crossings in Segment 1

Crossing Number	Description	Begin Milepost	Crossing Length		
			HDD	Bore	Open Cut
1	Walnut/Grayson Creek	0.3	1,125	--	--
2	Pacheco Creek	1.6	--	--	150
3	Peyton Slough (future alignment)	R1-4.0	1,280	--	--
4	Carquinez Strait	4.8	--	--	--
4 crossings	Footage Totals		2,405	--	150

Surface Water. The first surface waterbodies that the pipeline would cross would be in the vicinity of the confluence of Walnut Creek and Grayson Creek. The drainage areas for Walnut Creek (at Grayson Creek) and Grayson Creek (at Walnut Creek) are approximately 141 square miles and 18.4 square miles, respectively. The 100-year peak flows for Walnut Creek and Grayson Creek are approximately 25,000 cfs and 6,500 cfs, respectively. Both channels are trapezoidal in shape and levied and the flow regime is characterized as perennial. No gauging stations exist on these watercourses, so normal flow conditions are not known (Contra Costa County Flood Control District, 2003). No flow information was available for Peyton Slough.

The second surface waterbody to be crossed by the Proposed Project is Pacheco Slough at MP 1.6. Pacheco Creek, which is also levied, has an approximate drainage area of 2.5 square miles and a 100-year peak flow of 824 cfs (Contra Costa Count Flood Control District, 2003).

Water quality data for the Proposed Project within Segment 1 is only available for Pacheco Creek and is presented in Table D.8-2. Data related to poly-aromatic hydrocarbons and poly chloro biphenyls was not provided for Pacheco Creek.

Table D.8-2. 1993 and 2000 Conventional Water Quality Parameters for Pacheco Creek

Date	Ammonia (mg/l)	Dissolved Oxygen (mg/l)	Nitrate (mg/l)	PH	Phosphate (mg/l)	Salinity (psu)	Total Suspended Solids (mg/l)
3/04/93	0.11	11.1	0.181	8.2	0.08	NA	81.8
9/15/93	0.05	9.3	0.35	7.9	0.11	NA	45.9
2/08/00	0.13	9.1	0.333	6.7	0.058	ND	42.9
7/18/00	0.09	8.3	0.431	7.9	0.081	6.7	107.1

Notes: milligrams per liter (mg/l); Not Available (NA); Not Detected (ND)
Source: SFEI, 2003.

Groundwater. Groundwater along this segment is shallow. The nearest groundwater well (02N02W29R001M) for this segment monitored by the California Department of Water Resources (DWR) is located due south of the Proposed Project below Highway 4 near Pacheco. Complete well level data is provided from

February 1958 until March 6, 1974 and records the ground surface elevation at approximately 15 feet above sea level. The highest water levels were recorded at 15 feet during the summer, fall, and winter months of 1959. The lowest water level was recorded at -6.3 feet below sea level (21.3 feet below ground surface) in October 1964 (DWR, 2003).

Groundwater in this area is known to be contaminated by pesticides, and is subject to saline contamination from return irrigation flow. Dissolved solids are moderately high and range from 500 to 1,500 milligrams per liter (USGS, 1995).

Phase 1 Carquinez Strait Crossing

The Phase 1 crossing of the Carquinez Strait would involve construction around the eastern side of the Rhodia Plant site and a connection with the existing 14-inch pipeline just east of the railroad bridge across the Strait. The Carquinez Strait is a major shipping channel that connects the San Francisco Bay with the Sacramento–San Joaquin River Delta area. The Carquinez Strait is part of the Suisun Bay watershed as discussed in the Regional Setting and is included on the TMDL list with the same pollutants/stressors as the Suisun Bay.

The Carquinez Strait is the conduit through which passes runoff from approximately 40% of the State of California. It is fed by the Sacramento and San Joaquin Rivers but, being an arm of the sea, is little influenced by flood flows. Tides dominate the flow characteristics within the strait, which is approximately 100 feet deep at the location of the existing SFPP pipeline.

Phase 2 Carquinez Strait Crossing

Phase 2 of the Proposed Project would entail construction of a new 20-inch pipeline installed via a 6,800-foot HDD. The environmental setting for Phase 2 is similar to that described above for Phase 1. Phase 2 construction would involve only one waterway crossing (Carquinez Strait, described above).

Segment 2 (MP 6.1–17.6) – Benicia and I-680 Frontage

Segment 2 of the proposed pipeline route includes 11.4 miles along the north side of the Carquinez Strait, mostly running parallel to the I-680 Freeway where the pipeline would be installed in or adjacent to freeway frontage roads.

Surface Water. This segment crosses 13 waterways (listed in Table D.8-3), but only one major waterway (Sulphur Springs Creek), and this crossing would be nearly at the point that the creek flows into the Carquinez Strait. Ten crossings in this segment are minor drainages that cross the frontage road, and two bored crossings would cross below unnamed streams with perennial water flow.

Segment 3 (MP 17.6–24.5) – Cordelia

Surface Water. There are 11 surface water crossings in the Cordelia segment, as listed in Table D.8-4. Cordelia Slough and Ledgewood Creek would be crossed by directional drill, the rest would be bored or trenched. Cordelia Slough and Ledgewood Creek are relatively large streams with watersheds originating in the coastal range to the north and west of the crossing sites. Both streams are earthen and have been channelized and straightened by man at the site of the crossings. Cordelia Slough has a secondary channel fed by regulated flow from the slough itself, which would also be crossed by the pipeline in a bored crossing. Cordelia Slough and Ledgewood Creek drain to Suisun Slough, which discharges into Grizzly Bay. The distance to Grizzly Bay is approximately 7 miles from the Cordelia Slough crossing and 9 miles from the Ledgewood Creek crossing

Table D.8-3. Water Crossings in Segment 2

Crossing Number	Description	Begin Milepost	Crossing Length		
			HDD	Bore	Open Cut
5	Sulphur Springs Creek	R11A-6.8	800	--	--
6	Stream/railroad	7.4	--	60	--
7	Stream/drainage outfall	9.1	--	--	25
8	Stream	9.8	--	--	25
9	Stream	10.6	--	--	25
10	Stream/drainage outfall	12.1	--	--	25
11	Stream	13.8	--	--	25
12	Stream	13.9	--	--	25
13	Stream	14.2	--	--	25
14	Stream	R2-15.2	--	--	25
15	Stream	15.5	--	--	25
16	Stream	15.9	--	--	25
17	Stream	16.5	--	50	--
13 crossings	**Footage Totals**		**800**	**110**	**250**

Table D.8-4. Water Crossings in Segment 3

Crossing Number	Description	Begin Milepost	Crossing Length		
			HDD	Bore	Open Cut
19	Stream	17.5	--	100	--
20	Stream	R3-18.4	--	100	--
21	Cordelia Slough	19.2	800	--	--
22	Stream	19.5	--	200	--
23	Stream	R7-20.3	--	--	25
24	Suisun Creek	20.5	--	250	--
25	Drainage ditch	R4-21.7	--	50	--
26	Stream/drainage ditch	R8-22.9	--	--	25
27	Ledgewood Creek	R8-23.3	800	--	--
28	Stream	R8-23.6	800	--	25
29	Peytonia Slough	23.7	800	100	--
11 crossings	**Footage Totals**		**1,600**	**800**	**75**

Groundwater. Groundwater along Segment 3 is typical of groundwater along most of the pipeline route. The depth to groundwater is less than 30 feet along most of this reach, with depths approximately 5 feet at Cordelia Slough. As with Segment 2, groundwater in Segment 3 is subject to saline contamination from return irrigation flow. Dissolved solids are moderately high, ranging from 500 to 1,500 milligrams per liter (USGS, 1995).

Segment 4 (MP 24.5–30.7) – Fairfield/Suisun City

Surface Water. The Fairfield/Suisun City segment is one of the most developed/urbanized segment of the pipeline route. Three bored crossings would be required, and one open cut crossing, as shown in Table D.8-5. All are relatively minor urban stream crossings on or near existing roadways.

Table D.8-5. Water Crossings in Segment 4

Crossing Number	Description	Begin Milepost	Crossing Length		
			HDD	Bore	Open Cut
30	Stream/railroad	24.8	--	320	--
31	Laurel Creek	26.1	--	60	--
32	Flood control culvert	26.3	--	200	--
33	Stream/drainage outfall	27.9	--	--	50
4 crossings	**Footage Totals**		**--**	**580**	**50**

Groundwater. Depth to groundwater in this reach ranges from approximately 10 to 60 feet (based on USGS, 1995 groundwater elevations), increasing in a northeasterly direction along the pipeline route. Dissolved solids from saline return irrigation flow are moderately high (500 to 1,500 milligrams per liter -USGS, 1995).

Segment 5 (MP 30.7–65.1) – Solano and Yolo Counties Agricultural Area

Surface Water. This segment passes through the open space and agricultural lands of Yolo and Solano Counties, and includes 29 waterway crossings, listed in Table D.8-6. Five crossings, Ulatis Creek, Hass Slough, Putah Creek, a canal at MP 59.7, and the West Yolo Bypass, are major crossings and would require HDD. Ulatis Creek is in a man-made, straightened earth channel approximately 100 feet wide at the top. The creek drains by way of Cache Slough into the Sacramento River approximately 12 miles downstream of the pipeline crossing. Hass Slough consists of two channels approximately 40 feet wide at the location of the crossing. The HDD would bore beneath both, which are approximately 400 feet apart. Hass Slough drains into the Sacramento River through Cache Slough approximately 12 miles downstream of the crossing. Putah Creek is a large watercourse draining a watershed of approximately 640 square miles at the location of the crossing, with USGS-recorded peak discharges of nearly 50,000 cfs. At the location of the crossing the creek is approximately 300 feet wide. Putah Creek drains into the Putah Creek sinks and eventually to the Sacramento River via the Deep Water Canal Toe Drain and Cache Slough. The West Yolo Bypass is a man-made channel contained on the west side by a levee. At the location of the crossing it is approximately 80 feet wide. The bypass drains to the vicinity of the Putah Sinks and to the Sacramento River in the same manner as Putah Creek. All other pipeline crossings would be bored. There are no open cut crossings proposed on this segment.

Groundwater. Groundwater characteristics in Segment 5 are approximately the same as Segment 4, with dissolved solids decreasing in the northeasterly direction along the pipeline to approximately 0 to 200 milligrams/liter (USGS, 1995).

Segment 6 (MP 65.1–69.9) – West Sacramento

Surface Water. This segment is within the industrial areas of West Sacramento and includes only two crossings, both proposed to be crossed by HDD, as shown in Table D.8-7. The East Yolo Bypass is a man-made channel serving as the toe drain for the Sacramento River Deep Water Channel. Flow in the bypass channel eventually drains into the Sacramento River approximately 30 miles downstream of the pipeline crossing. Washington Lake is a remnant of an old stream channel in an industrial area of West Sacramento.

Table D.8-6. Water Crossings in Segment 5

Crossing Number	Description	Begin Milepost	Crossing Length		
			HDD	Bore	Open Cut
34	Stream	R5-32.0	—	50	—
35	Irrigation canal	R5-32.7	—	40	—
36	Irrigation canal	33.8	—	40	—
37	Stream	35.2	—	80	—
38	Irrigation canal	36.7	—	40	—
39	Irrigation canal	38.8	—	40	—
40	Ulatis Creek	40.7	800	—	—
41	Maine Prairie Creek	41.9	—	100	—
42	Irrigation canal	R9-42.2	—	80	—
43	Hass Slough	R9-42.8	1,000	—	—
44	Irrigation canal	R9-43.7	—	80	—
45	Stream	R9-44.8	—	120	—
46	Stream/drainage ditch	R9-45.3	—	120	—
47	Stream	R9-45.8	—	100	—
48	Irrigation canal	R9-46.5	—	50	—
49	Irrigation canal	R9-46.6	—	50	—
50	Irrigation canal	R9-48.2	—	50	—
51	Irrigation canal	R9-48.2	—	50	—
52	Stream/drainage ditch	R9-50.3	—	80	—
53	Stream	R9-51.0	—	80	—
54	Stream	R9-51.2	—	100	—
55	Stream	R9-52.7	—	80	—
56	Stream	R9-53.3	—	150	—
57	Stream	R9-53.9	—	80	—
58	Stream	R9-54.1	—	100	—
59	Putah Creek	57.8	800	—	—
60	Canal	59.7	800	—	—
61	Canal	60.5	—	100	—
62	West Yolo Bypass (Willow Slough)	62.0	800	—	—
29 crossings	**Footage Totals**		**3,400**	**1870**	**—**

Groundwater. Groundwater in this segment is shallow (approximately 10 feet below the ground surface). This segment is outside the saline irrigation return flow area and dissolved solids range from 0 to 200 milligrams per liter. There are other known groundwater contaminants, including boron and nitrate, in this area (USGS, 1995).

Table D.8-7. Water Crossings in Segment 6

Crossing Number	Description	Begin Milepost	Crossing Length		
			HDD	Bore	Open Cut
63	East Yolo Bypass	65.2	800	--	--
64	Washington Lake	65.8	800	--	--
2 crossings	Footage Totals		1600	--	--

Segment 7 – Wickland Connection

Surface Waters. The Wickland Connection for the Proposed Project will not cross any drainage features. The 4,100-foot, 12-inch pipeline connection would be placed in a low lying area parallel the outboard side of an existing levee that separates West Sacramento and the Yolo Bypass.

Groundwater. Groundwater characteristics of Segment 7 are the same as those in Segment 6.

D.8.1.3 Environmental Setting: Existing Pipeline ROW Alternative

The Existing Pipeline ROW Alternative would be a new pipeline installed in the route of the existing pipeline between Concord and Sacramento. The major waterways crossed by this route are presented in Table D.8-8.

D.8.1.4 Environmental Setting: No Project Alternative

The actions occurring for the No Project Alternative would take place in the same general area as the Proposed Project and the Existing Pipeline ROW Alternative. Trucks and trains would likely use I-80 and the UPRR tracks, respectively, and construction along the existing pipeline to increase its throughput would occur in the same area as that described in Sections D.8.1.2 and D.8.1.3 above.

Table D.8-8. List of Major Waterway Crossings – Existing Pipeline ROW Alternative

Crossing Number	Name of Waterway
1	Pacheco Creek
2	Peyton Slough
3	Carquinez Strait
4	Goodyear Slough
5	Sulphur Springs Creek
6	Cordelia Slough
7	Chadbourne Slough
8	Wells Slough
9	Boynton Slough
10	Peytonia Slough
11	Laurel Creek
12	Alamo Creek
13	Gibson Canyon Creek
14	McCune Creek
15	South Fork of Putah Creek
16	Putah Creek
17	Willow Slough
18	West Yolo Bypass
19	East Yolo Bypass
20	Washington Lake

D.8.2 Applicable Regulations, Plans, and Standards

D.8.2.1 Federal

Clean Water Act

The Clean Water Act (33 USC §1251), formerly the Federal Water Pollution Control Act of 1972, was enacted with the intent of restoring and maintaining the chemical, physical, and biological integrity of the waters of the United States.

Section 402 of the Clean Water Act regulates point source discharges to surface water via the National Pollutant Discharge Elimination System (NPDES) Permit. Stormwater discharges during construction and operation of a facility also fall under this act and must be addressed through either a project specific or general NPDES permit. In California, the nine Regional Water Quality Control Boards (RWQCBs) administer the requirements of the Clean Water Act. The San Francisco RWQCB and the Central Valley RWQCB will oversee the NPDES permit requirements for this project.

Section 404 of the Act regulates the discharge of dredged or fill material into waters of the United States, including rivers, streams and wetlands. The Army Corps of Engineers (USACE) issues site-specific or general (nationwide) permits for such discharges.

Section 401 of the Clean Water Act provides for State certification of federal permits allowing discharge of dredged or fill material into waters of the United States. These certifications are issued by the RWQCBs. For this project, any Section 401 certification may be handled through compliance with Waste Discharge Requirements (WDR's) under the California Water Code.

Coastal Zone Reauthorization Amendments of 1990 (CZARA)

Congress passed this reauthorization of the Coastal Zone Management Act of 1972 in order to continue protection for coastal waters and estuaries because of their high value and declining existence. Section 6217 of CZARA required each coastal state to have coastal zone management programs and to prepare and submit a Coastal Nonpoint Pollution Control Program. The purpose of this program is to develop and implement management measures for nonpoint-source pollution, allowing restoration and protection of coastal waters.

D.8.2.2 State

Streambed Alteration Agreement

A California Department of Fish and Game (CDFG) "1603 Agreement" will be required for pipeline construction within riparian areas. This is an agreement and not a permit and the areas of jurisdiction are addressed on a case-by-case basis. This agreement is between the project proponent and the CDFG regarding the location, nature, and extent of disturbance, and mitigation.

Porter Cologne Water Quality Control Act

The Porter Cologne Water Quality Control Act of 1967, Water Code section 13000 et seq., requires the State Water Resources Control Board (SWRCB) and the nine RWQCBs to adopt water quality criteria to protect State waters. These criteria include the identification of beneficial uses, narrative and numerical water quality standards, and implementation procedures. The criteria for the project area are contained in the San Francisco Bay Basin Plan. These standards are typically applied to the Proposed Project through the WDR. The Porter Cologne Water Quality Control Act also requires the SWRCB and the nine RWQCBs to ensure the protection of water quality through the regulation of waste discharges to land.

Water Well Protection

Guidelines of the State Department of Health Services (DHS) require that new wells be located at least 200 feet from a petroleum pipeline. Therefore, construction of an oil pipeline within 200 feet of an existing well would need to be reviewed by DHS to ensure that the pipeline does not become a source of contamination for the well. Special pipeline casings or other contamination-preventing devices may be required within the 200-foot radius.

California Government Code Sections 51017.1 and 51017.2 require a Pipeline Wellhead Protection Plan to be prepared for pipelines located within 1,000 feet of a public drinking water well.

California Implementation of CZARA

The SWRCB oversees California's compliance with CZARA (described under federal regulations, above). This Act regulates pollutants such as: excess fertilizers, herbicides and insecticides from agricultural lands and residential areas; oil, grease and toxic chemicals from urban runoff and energy production; sediment from improperly managed construction sites, crop and forest lands and eroding streambanks; salt from irrigation practices and acid drainage from abandoned mines; bacteria and nutrients from livestock, pet wastes and faulty septic systems. The program is funded by the State of California, and supported by the U.S. Environmental Protection Agency (EPA), which administers federal funds, and the National Oceanic and Atmospheric Administration approved California's polluted runoff control program in 2000.

D.8.2.3 Regional and Local

Ministerial Encroachment Permits

Local regulatory agencies such as the Contra Costa Flood Control District, Solano County Water Agency, Maine Prairie Water District, Reclamation District 2068 and the Sacramento Yolo Port District require encroachment permits for any Proposed Project that would entail water crossings.

D.8.3 Environmental Impacts and Mitigation Measures for the Proposed Project

D.8.3.1 Introduction

In assessing environmental impacts and proposing mitigation measures for the Proposed Project and alternatives related to hydrology and water quality, an overview of the definition and use of significance criteria related to these areas is first presented. Subsequently, impacts are identified and a level of significance is assigned to each. Specific mitigation measures are proposed to avoid or minimize adverse impacts on hydrology and water quality.

D.8.3.2 Definition and Use of Significance Criteria

Adverse impact on *surface* waters would be considered significant and would require additional mitigation if project construction or operation would:

- Result in either short- or long-term violation of federal, tribal, or State agency water quality standards or water quality objectives.
- Alter channel bed armoring, bank composition, or stream hydraulic characteristics so it results in short- or long-term erosion.
- Cause the resuspension of contaminated bottom sediments that would degrade the quality of water downstream in violation of federal or State agency water quality standards.
- Result in increased sedimentation that adversely affects the operation of irrigation water control structures, gates, or valves or the quality of municipal water supply reservoirs.
- Reduce streamflow quantity where such a flow change would significantly damage either beneficial uses or aquatic life.
- Increase the potential for flooding outside the stream channel.
- Result in the pipeline being subject to damage and potential rupture by stream scour or bank erosion.
- Place permanent structures within the 100-year flood plain that would be damaged by flooding.
- Increase soil or wind erosion rates or sedimentation such that degradation of water quality to below federal or State standards would result.
- Degrade the integrity of structures (e.g., bridges, pipelines, utilities) due to erosion and improper conveyance of stormwater during construction and operation.

Adverse impact on *groundwater* would be considered significant and would require additional mitigation if project construction or operation would:

- Alter the flow of groundwater to local springs or wetland areas.
- Interrupt or degrade groundwater used for private or municipal purposes.
- Result in either short- or long-term violation of federal, tribal, or State agency water quality standards or water quality objectives.

D.8.3.3 Impacts of Pipeline Construction

All water resources impacts associated with construction of the proposed pipeline, including surface water and groundwater impacts, are general and apply equally to all segments except as otherwise described below. Surface water impacts are described first below, followed by discussion of groundwater impacts. For impacts associated with the Proposed Project's demand for water supply during project construction (e.g., for hydrostatic testing, dust suppression, etc), refer to "Impact US-2: Water Supply" in Section D.11.3.3.

Surface Water Impacts from Construction

The following discussion presents an overview of the general types of anticipated surface water impacts associated with pipeline construction, followed by detailed discussions of measures proposed to mitigate potentially significant impacts. Three impacts and six mitigation measures are identified below.

Impact HS-1: Discharge of Fine Sediments into Streamflow During Construction

Construction activities including ROW clearing can disturb stream sediments and leave exposed soil that can be washed into nearby waterways. (Potentially Significant, Class II)

Impact Discussion

Discharge of fine sediments into streamflow during construction activities can cause: gullies to grow to large size; loss of vegetative habitat; erosion damage to property; public safety risks; and possible exposure of the pipeline. In addition, fine sediments discharged into the streamflow can cause serious deterioration of water quality. Water quality impacts are especially serious if baseline water quality is impaired. The Pacheco Slough crossing is considered to have a higher potential for in-stream sediment disturbance during construction than the other trenched crossings. This stream channel is steep-sided and relatively deep, with a potential for lateral erosion. Given the need to protect the pipeline against streambed scour and lateral erosion that could result in pipeline rupture (see Impact HS-3 and associated mitigation measures), a wide, deep trench in a potentially flowing stream may be necessary. The potential for construction to introduce fine sediments to waterways is potentially significant (Class II).

Mitigation Measures for Impact HS-1: Discharge of Fine Sediments into Streamflow During Construction

HS-1a Construction Plans to Define Water Crossings. Construction work in stream channels shall follow construction plans and a schedule approved by the CSLC, applicable RWQCB, and California Department of Fish and Game submitted at least 60 days prior to the start of construction. Construction plans shall show, as applicable, stream plan view, stream cross section, location and burial depth of the pipeline, trench dimensions, location of access roads and spoil piles, stream crossing techniques, culvert sizes, diversion structures, sediment control structures, equipment to be used, staging areas, and any other information relevant

to the crossing as deemed appropriate by the reviewing agency. Plans showing typical rather than site-specific crossing techniques may be used for routine crossings of small drainageways at the discretion of the reviewing agency.

No material that does not have a specific purpose related to pipeline construction within the stream shall be placed in the streambed. No material shall be left in the streambed after construction except as allowed by the approved plans. The channel cross section shall not be permanently altered except as allowed by the approved plans.

Streambed construction shall be accomplished as quickly as possible as approved by the responsible agency and only during the period of stream low flow (generally mid-June to end of October). The period of construction may be subject to further constraint in other environmental issue areas.

HS-1b Open Cut Crossing Methods. Open cut construction in streams shall be done using "in the dry" construction techniques. "In the dry" construction consists of diverting the streamflow into a controlled channel or culverts (flume pipes) on one side of the streambed to provide a construction zone free of surface flow.

HS-1c Erosion Control Procedures. SFPP shall use erosion control procedures, including the provisions defined below. The specific procedures shall be developed by an engineer or other appropriate professional with expertise in the field of hydrology and sediment transport, and shall include the following items which shall be used during all construction activities:

- **Where the pipeline will be constructed on slopes of 15% or greater, permanent erosion control features shall be installed, such as terraces, to control long-term erosion.**
- **Disturbed areas shall be restored to their original cross section and revegetated.**
- **Specific best management practices (BMPs) for erosion and sediment-control techniques shall be used during construction (such as silt fences, straw bale dikes, diversion channels).**
- **Permanent erosion control measures shall be included in project design (i.e., water bars, trench dams, diversion ditches, water bars, energy dissipators, dips, staked bales, erosion control mats, sediment basins, and berms).**
- **Erosion-control structures (such as water bars and terraces) shall be left in-place on hillsides to control gully erosion after construction.**
- **Streams be crossed at right angles, where possible, to minimize disturbance. If not possible, SFPP shall consult with the CSLC and other appropriate agency personnel for approval prior to construction of the stream crossing.**
- **ROW drainage shall be directed away from stream crossing sites.**
- **Stream channel disturbance shall be minimized by staying within the construction ROW.**

These procedures shall be implemented during construction, and compliance monitoring shall occur during and one year after construction of the project to ensure that erosion does not expose the pipeline. An annual report shall be submitted to the CSLC and applicable RWQCB describing status of erosion prevention and restoration/revegetation efforts one year after completion of construction.

HS-1d Pacheco Slough Crossing. If any water is present or expected to be present during construction in Pacheco Slough, Pacheco Slough shall be crossed using directional drilling methods (HDD and/or boring), as approved by the CSLC and the appropriate jurisdictional agencies.

Residual Impact. With implementation of Mitigation Measures HS-1a through HS-1d, impacts from discharge of fine sediments into streamflow during construction would be less than significant.

Impact HS-2: Discharge of Chemical Contaminants into the Streamflow During Construction

Contaminants leaking from construction equipment or discharge of hydrostatic test or dust control water could degrade surface or groundwater quality. (Potentially Significant, Class II)

Impact Discussion

Usually the amount of contaminants that would leak from construction equipment is relatively small. There is a higher risk of contamination from spills at staging and refueling sites. Leaked or spilled pollutants could then wash into a stream or waterbody during a storm event and degrade the surface water quality causing potentially significant impacts. However, under requirements of the National Pollutant Discharge Elimination System, a Hazardous Materials Management Plan (HMMP) and a Stormwater Pollution Prevention Plan (SWPPP) would be submitted to the SWRCB or applicable RWQCB. Compliance with a well-prepared HMMP and SWPPP would ensure that the potential for contamination during construction would be less than significant (Class III).

Approximately 120,000 gallons of water per day during the eight-month construction period would be necessary for dust suppression and 5.4 million gallons of water would be required for hydrostatic testing. The potential also exists to degrade the aquatic habitat between through the discharge of hydrostatic test water into those streams. Several construction spreads would work simultaneously along the pipeline route. Up to 15,000 gallons per day would be required at a single rural spread during dry, windy conditions. Section D.11 (Utilities and Service Systems) addresses the potential for this volume of water to affect local water supplies. This section considers the impact of runoff of this water on surface water quality.

Water quality degradation from the introduction of toxic substances in hydrostatic test water would be mitigated to less than significant levels (Class II) through implementation of Mitigation Measure HS-2a. Water used for dust control would be in comparatively small quantities, and most of it would evaporate after being spread on work areas and dirt roads. Therefore, the impact of dust control water on water quality is considered to be an adverse but less than significant (Class III) impact.

Mitigation Measure for Impact HS-2: Discharge of Chemical Contaminants into the Streamflow During Construction

HS-2a Hydrostatic Test Water. All hydrostatic test water shall be discharged to appropriate waste handling facility and not to surface waterbodies, unless otherwise approved by the applicable RWQCB.

Residual Impact. With implementation of Mitigation Measures HS-2a, impacts from discharge of chemical contaminants into the streamflow during construction would be less than significant.

Impact HS-3: Contamination of Surface Water by Directional Drilling Fluid Seepage

Surface water can be contaminated during directional drilling if drilling fluid is released. (Potentially Significant, Class II)

Impact Discussion

Seepage of drilling fluids such as bentonite (one material used to refill the directional bore) or similar materials could occur if the pipeline bores encounter fractures in the underlying rock, and drilling fluid pressures are great enough to force the material to the surface. Drilling fluids can emerge on the ground surface or within the waters of the waterway being crossed. Because there are 46 proposed bore and HDD surface water crossing locations as defined in Section D.8.1 above, the possibility of such a drilling fluid release (also called a "frac-out") is a major concern. A release of drilling fluids would adversely affect water quality down stream of the seepage causing potentially significant impacts (Class II).

Mitigation Measure for Impact HS-3: Contamination of Surface Water by Directional Drilling Fluid Seepage

HS-3a Response to Unanticipated Release of Drilling Fluids. Sixty days prior to the commencement of directional boring activities near water crossings, SFPP shall prepare and submit for CSLC approval an HDD "frac-out" prevention and response plan which contains the following provisions (or similar measures which have the same effect):

- **HDD crews shall strictly monitor drilling fluid pressures.**
- **Obtain site-specific geotechnical data at all water crossings where HDD is to be used to determine the appropriate depth below bed of waterway.**
- **Implement sizing techniques (move bores back and forth slowly to keep track of potential frac-outs)**
- **Consider potential application of surface casings to add a protective outer layer.**
- **Conduct Geotech bores in locations that would prevent drilling mud from escaping through boreholes.**
- **No nighttime drilling shall be allowed unless absolutely required.**
- **Containment equipment for drilling fluids shall be maintained on site.**
- **Turbidity downstream of the drill site shall be monitored.**
- **Work shall be immediately stopped if a seep into a stream is detected such as by a loss in pressure or visual observation of changes in turbidity or surface sheen.**
- **All bentonite seeps into waters of the State or sensitive habitat shall be immediately reported to the Project's resource coordinator, the CSLC, and the appropriate resource agencies (i.e., NOAA, USFWS, CDFG, Reclamation Board, USACE, applicable RWQCB's, applicable county [Contra Costa, Solano, Yolo], and DWR).**
- **Use non-toxic fluorescent dye in the drilling mud to allow easier identification of frac-outs.**
- **On-site boats with monitors shall be maintained where appropriate.**

- **In the event of a release during construction, SFPP shall assess the extent of potential damage to fisheries and carry out appropriate mitigation/compensation procedures. Impacts to consider include curtailment of access to fishing areas, contamination of fish and habitat, loss of income to commercial fishing interests and businesses. Procedures for assessing damage should include field surveys to determine extent of damage during and soon after the release, and long-term monitoring to determine long-term effects to habitat, fish, and fishing interests.**

Residual Impact. With implementation of Mitigation Measure HS-3a, impacts from contamination of surface water by directional drilling fluid seepage would be less than significant.

Groundwater Impacts from Construction

The following discussion presents an overview of the general types of anticipated groundwater impacts associated with pipeline construction, followed by discussions of measures proposed to mitigate potentially significant impacts, if applicable. Three impacts and one mitigation measure are identified below.

Impact GW-1: Localized Change In Groundwater Recharge Rates

Groundwater recharge rates in the vicinity of the pipeline construction ROW could be temporarily affected by the use of heavy construction equipment. (Less Than Significant, Class III)

Impact Discussion

Minor and temporary localized changes in the volume of recharge from surface runoff to groundwater could result from clearing a 100-foot-wide ROW corridor with heavy equipment. In some cases, ground clearing would increase the local rate of recharge; in others, it would decrease the rate of recharge depending on slope and permeability of exposed material. Groundwater levels could also be locally affected by the application of dust suppressant or the withdrawal of water for hydrostatic testing. This impact is considered to be adverse but not significant (Class III) and no mitigation is required.

Mitigation Measure. None required.

Residual Impact. Less than significant.

Impact GW-2: Groundwater Quality Degradation from Pollutants during Construction

An accidental release of pollutants during construction activities could degrade groundwater quality. (Potentially Significant, Class II)

Impact Discussion

Areas that have been stripped of vegetation and topsoil would provide less treatment to infiltrating runoff than areas that remained undisturbed. Risk of direct groundwater contamination would likely be increased in areas of shallow groundwater by construction-related activities. In addition, the use of motorized heavy equipment (which can release hydraulic fluid and fuel) and stored construction materials would increase the risk of introducing contaminants to groundwater exposed in a trench or to near-surface groundwater. Directional drilling is proposed for several major waterway crossings. The chemicals used to facilitate the drilling process (drilling muds) can be oil- or water-based, and other chemicals are sometimes used.

Mitigation Measure for Impact GW-2: Groundwater quality degradation from pollutants during construction

The requirements discussed under Impact HS-2 above would address pollution prevention requirements for construction so that Impact GW-2 would be less than significant (Class III).

Residual Impact. With implementation of NPDES requirements for preparation of a SWPPP and HMPP, Impact GW-2 would be less than significant.

Impact GW-3: Water Supply System Damage

Trenching and other construction activities increase the risk of accidental damage to a well or supply lines from a well by heavy equipment. (Potentially Significant, Class II)

Impact Discussion

Large construction vehicles could affect a groundwater supply system located in the construction ROW by accidental direct impact. This impact would likely be limited to individual receptors and could be quickly repaired with replacement of damaged material. The impact is considered to be adverse and potentially significant (Class II); mitigation is required.

Mitigation Measure. Implementation of Mitigation Measure GW-4b, Water Well Protection (see Impact GW-4 below).

Residual Impact. Less than significant (Class II).

D.8.3.4 Impacts of Pipeline Accidents

All water resources impacts associated with pipeline accidents, including surface water and groundwater impacts, are general and apply equally to all segments except as otherwise described below.

Surface Water Impacts of Pipeline Accidents

The following discussion presents an overview of the general types of anticipated surface water impacts associated with pipeline accidents, followed by detailed discussions of measures proposed to mitigate potentially significant impacts. Two impacts and two mitigation measures are identified below.

Impact HS-4: Risk of Surface Water Contamination from Pipeline Rupture Caused by Hydraulic Action

Streambed scour could potentially rupture the pipeline causing a release of petroleum products. (Potentially Significant, Class II)

Impact Discussion

The buried pipeline can be uncovered and exposed by bank erosion or streambed scour during significant flood events. Exposure of the pipeline would increase the risk of pipeline rupture. In the event of a pipeline rupture, spilled petroleum product would flow into the surface waterbody causing potentially significant degradation of water quality downstream.

Mitigation Measures for Impact HS-4: Risk of Surface Water Contamination from Pipeline Rupture Caused by Hydraulic Action

HS-4a Adequate Pipeline Burial and Protection. The minimum burial depth of the pipeline at stream crossings shall be equal to or greater than the 100-year depth of scour plus four feet, the 100-year depth of scour times 1.3 (whichever depth is greater), or such other minimum depth required by the CSLC for waterway crossings within its jurisdiction based on the results of final geotechnical analysis. A registered civil engineer shall demonstrate the pipeline burial depth at each crossing to be at or below this depth. All pipeline burial plans, with backup engineering analysis and calculations, shall be reviewed and approved by the CSLC 60 days prior to construction.

SFPP shall monitor pipeline integrity and cover depth routinely and after floods or other high flow events at locations where the pipeline crosses under or immediately adjacent to streams. SFPP shall immediately correct improperly protected pipe, and record incidences of uncovered or thinly covered pipe near streams for future monitoring and maintenance.

The minimum burial depth of the pipeline at stream crossings shall be extended laterally into the stream bank a distance beyond any bank erosion that can reasonably be expected to occur during a 100-year flood or during the life of the project as determined by a registered civil engineer, hydrologist, or other professional with expertise in stream mechanics. Bank protection may be substituted for burial below the depth of scour at the discretion of the CSLC. All plans for setbacks and/or bank protection, with backup engineering analysis and calculations, shall be reviewed and approved by the CSLC 60 days prior to construction.

Except at stream crossings, the pipeline shall be located a sufficient distance from watercourses to avoid any bank erosion that can reasonably be expected to occur during a 100-year flood or during the life of the project as determined by a registered civil engineer, hydrologist, or other appropriate professional with expertise in stream mechanics. If it is not practical to avoid anticipated bank erosion, the pipeline in those areas shall be buried to a depth below the 100-year depth of scour for the adjacent stream as defined above. Bank protection may be substituted for burial below the depth of scour at the discretion of the CSLC and the property owner. Plans for setbacks and/or bank protection, with backup engineering analysis and calculations, shall be reviewed and approved by the CSLC 60 days prior to construction.

Impact HS-5: Accidental Contamination of Surface Water with Pipeline Product

Contamination of surface water could result from accidental rupture of the pipeline during operation or maintenance. (Significant, Class I)

Impact Discussion

Pipeline ruptures can occur from a variety of causes such as scour and erosion, third-party damage, corrosion, landslides, earthquakes, construction defects, or long-term pipeline weakening. Other causes of pipeline accidents are addressed in Sections D.7 (Geology) and D.2 (Pipeline Safety). Based on the analysis presented in Section D.2, a large product spill potentially resulting in concentrations of toxic components in surface water and reaching a regional waterway is expected to occur at least once during the lifetime of the pipeline (one spill greater than 1,000 barrels is expected every 37 years).

Because of the high number of waterway crossings along the proposed route, it is likely that such a large spill would contaminate surface waters.

The discharge of pipeline product into the streamflow is the most damaging impact to surface water that could result from the construction or presence of the pipeline. Spilled product entering a stream would be transported downstream with the flow until captured by emergency response techniques, captured in a reservoir, or dissipated. The petroleum product carried by the pipeline contains chemicals that are flammable, toxic, and carcinogenic and which can destroy aquatic life and threaten human health and safety.

Gasoline is a mixture of petroleum hydrocarbons and other non-hydrocarbon chemical additives, such as alcohols and ethers. Diesel and jet fuel are middle distillates and may contain 500 individual compounds. Gasoline is more mobile than diesel or jet fuel due to the lower molecular weights of its components. The lower molecular weight results in lower viscosity, higher volatility, and moderate water solubility. Gasoline released to the environment contains high percentages of aromatic hydrocarbons, which are among the most soluble and toxic hydrocarbon compounds. Diesel and jet fuel tend to be heavier, less water soluble, and less mobile than gasoline. As a petroleum fuel moves through the environment as free-product, the fluid loses its lighter components and becomes more viscous, slightly denser, less volatile, and less mobile than fresh product. These characteristics influence the extent of contamination within a given period of time (diesel and jet fuel will travel more slowly than gasoline) the effectiveness of remediation (gasoline vaporizes more easily than diesel or jet fuel), and the toxicity of contamination (gasoline contains more toxic components).

Accidental spills from any cause can occur in any of the watercourse crossings. Due to the frequency and magnitude of accidental spills (as defined in Section D.2), there is the potential to introduce high concentrations of toxic materials, such as the water-soluble carcinogen, benzene, into the surface water.

Concentrations of benzene can be used as an indicator of water contamination from gasoline. The distance required to dilute a spill to the point where the benzene concentration would not have an adverse impact depends on the volume of water required for dilution, and the time it would take for the stream to deliver this volume of water at the specified stream discharge rate. Therefore, flow velocity at the point of contamination determines the extent of contamination and the ability of the streams to absorb and dilute the spilled product. In general, it is difficult to predict specific surface water contamination scenarios due to the infinite potential combinations of spill location, spill volumes, spill rates, product content, proximity to surface water, time of year and surface water discharge.

It is possible that there would be no spills during the life of the project. It is also possible that the number of spills would be greater than the scenarios presented in Section D.2 of this EIR (Pipeline Safety and Risk of Accidents). Since spills can occur anywhere along the route of the buried pipeline, many spills may not reach surface water at all. However, since it is impossible at this time to know where along the routes spills will occur, and since spills reaching the surface will run downhill toward surface water, it is assumed that any spill can potentially reach surface water with water quality consequences.

The proposed route crosses areas of the CALFED Bay-Delta Program and through the Primary Zone of the Legal Delta (includes agricultural lands in Solano County and the Yolo Bypass in Yolo County), which is, therefore, within the jurisdiction of the Delta Protection Commission. It is the Commission's mandate to protect, maintain, and enhance the Delta's existing agricultural, recreational, and wildlife values. In addition to the Delta, the Carquinez Strait, the Suisun Slough and wetlands in the Suisun Marsh, Walnut Creek, and Ledgewood Creek are all waterbodies that are listed as "impaired" under the Clean Water Act Section 303(d). Impaired waterbodies require especially strict water quality protection standards.

There is a probability that a large product spill (greater than 1,000 barrels) could affect surface water during the lifetime of the pipeline, and these spills could affect highly sensitive surface water resources, including the threatened waterbodies mentioned above. Therefore, this impact is classified as significant and unmitigable (Class I).

Mitigation Measure for Impact HS-5: Accidental Contamination of Surface Water with Pipeline Product

HS-5a Spill Response Plan to Protect Waterways. The Supplemental Spill Response Plan defined in Mitigation Measure S-2a (Section D.2) shall include specific measures for containment and clean-up of product spills that could possibly reach surface water either directly or through any conduit including overland and subsurface flow. This plan shall be submitted to the CSLC for review and approval 60 days prior to pipeline construction.

Residual Impact. Impact HS-5 is significant even with implementation of Mitigation Measure HS-5a. **A Statement of Overriding Considerations would be required for project approval.**

Groundwater Impacts of Pipeline Accidents

This section describes the types of impacts that can occur to groundwater resources from an accident associated with the petroleum products pipeline. In order to illustrate these impacts, following are two case history descriptions of leaks that occurred on SFPP's LS 25. These incidents demonstrate the types of impacts that can be caused to groundwater and subsurface facilities when a pipeline leaks.

Case History 1: SFPP Pipeline (LS 25) at Elmira, CA

As reported in a remediation report prepared for SFPP in September of 1996, a ¾-inch hairline crack in SFPP's 14-inch pipeline caused a pipeline leak adjacent to UPRR tracks, just west of A Street in the Town of Elmira, California. The first response to the incident was that the City of Vacaville Engineering Public Works Utility Division noted that fumes were detected in the Town's sewer system. On September 10, the City called SFPP and the pipeline was shut down.

While many pipeline accidents are caused by third-party damage and corrosion, this crack was caused by a manufacturing defect at the seam. This type of leak can be difficult to detect. When the 14-inch pipeline was built in 1967, high resistant welding was not yet available. Though there is no technology available to detect the exact quantity of a hairline-crack leak, it is estimated that between 20,000 to 60,000 gallons (470 to 1,400 barrels) of gasoline leaked through the crack. The pipeline was replaced with a new piece of hydrostatically tested steel-plate, welded pipe (Geomatrix Consultants, 2000a and 2000b).

Impact Summary. The contamination impacted a portion of the Town of Elmira's underground utility network and entered the Town's groundwater supply. The contamination spread quickly within the more porous trench backfill materials. The heavy rains of 1996 may have facilitated contamination in surrounding creeks and marshes. The contaminated soil near the leak was excavated and extraction wells were installed to remove contamination from utility trench areas and groundwater. Due to contamination to Solano Irrigation District's deep groundwater wells, the system was isolated, flushed out, and some lines were replaced. SFPP also provided bottled water to the town following the spill through June

1997. Remediation of groundwater continues at a fenced site adjacent to the UPRR in central Elmira (Geomatrix Consultants, 2000b).

Case History 2: SFPP Pipeline at Yolo Bypass Leak Site

On April 21, 1990, approximately a half-mile north-northwest of West Sacramento and 80-feet north of the SPRR tracks, a ripper blade attached to excavation equipment damaged SFPP's 14-inch-diameter pipeline (LS 25). Loss in pressure of the pipeline was noted by SFPP personnel, and the pipeline and upstream block valve were immediately shutdown. SFPP estimated that approximately 2,251 barrels (95,667 gallons) were discharged due to the damage to the pipeline. Approximately 500 feet of pipeline damaged by construction equipment was replaced. Repair was completed on April 24, 1990.

Impact Summary. Gasoline flowed from the damage point into a dry agricultural runoff ditch and along the ditch for approximately 1,200 feet. Remediation included excavation of contaminated soils and extraction of free product.

Impact GW-4: Contamination of Groundwater

Drinking water could be affected if contaminants released in groundwater migrated to a well used for municipal or private drinking water purposes. (Significant and Unmitigable, Class I).

Impact Discussion

Because the pipeline is buried and the project area has relatively shallow groundwater, it is likely that groundwater could become contaminated from release of product from a pipeline accident (as occurred in the Elmira event described above). In general, the severity, duration, nature, and extent of impacts on groundwater resources from a contaminant release resulting from a pipeline accident would depend on a large number of interdependent factors including volume released, rate of release, land slope, vegetative cover, soil type and thickness, underlying geology, depth to groundwater, aquifer characteristics, distance from surface water, weather, and effectiveness of emergency response. The fate and transport of hydrocarbons from a pipeline fuel release can be described qualitatively based on the (1) hydrogeologic settings typical of the proposed route and alternative routes; (2) factors influencing the significance of impacts on groundwater resources and drinking water from groundwater summarized in Tables D.8-9 and D.8-10; and (3) the volume and rate of fuel released.

The likelihood that a drinking water supply from groundwater would become contaminated by a pipeline accident and the extent of that contamination would depend not only on the factors listed in Table D.8-9, but also on the distance of a well (or other receptor such as a spring source of drinking water) from the release site, aquifer characteristics, temporal variation in the water table, and direction of groundwater flow. Additional factors that influence the nature and extent of potential drinking water contamination from a groundwater source are summarized in Table D.8-10.

A fuel release that goes undetected until it contaminates groundwater would most likely be either a slow, undetected leak and occur in an area where leaking fuel would not be easily observed at ground surface, or a pipeline rupture. The depth to which petroleum fuel would penetrate the subsurface in the event of a slow leak is most dependent on the volume discharged. In the event of a slow leak, the volume of fuel discharged to the environment may be great before the leak is detected.

A fuel release from the proposed pipeline would be expected to move initially away from the point of release under pressure. Portions of the fluid would migrate along the pipeline trench, portions would likely reach

Table D.8-9. Relative Influence of Parameters on Groundwater Quality Resulting from an Accidental Contaminant Release

Parameter	Influence on Impact
Volume released	The amount of released product influences the rate of migration and extent of groundwater contamination. Released fuel may be contained in the vadose zone and not reach groundwater depending on depth to groundwater, soil thickness, porosity and permeability, slope, and effectiveness of emergency response activities.
Rate of release	This variable could increase or decrease the extent of groundwater contamination depending on duration of the leak, ground slope, and permeability of material directly underlying the pipeline.
Fuel type	The rates of fluid migration toward, and in contact with, aquifers depends on viscosity and density of the fluid. As viscosity and density increase, migration rates tend to decrease. Gasoline tends to migrate more quickly than heavier fuels such as diesel and jet fuel.
Land slope	Fluids released from a buried pipeline on a sloped area may migrate, in part, as overland flow until runoff velocity slowed on flatter surfaces where the flow would have a larger vertical component. Steeper slopes would direct more fuel away from groundwater resources. Slopes to surface water would direct the flow of released fuel into surface water thereby reducing the volume of fuel that could migrate to groundwater.
Soil thickness and grain size	An increase in soil thickness increases fluid retention and decreases the potential amount of fuel that would reach groundwater depending on the effectiveness of emergency response.
Underlying geology	Decreased permeability of underlying material would retard the migration of released fuel. Fluids released onto fractured bedrock or highly permeable sand and gravel would migrate quickly. Less permeable material such as silt, clay or unfractured bedrock would inhibit downward migration of released fuel.
Distance of spill site from groundwater	The volume of product to reach groundwater would decrease with increasing distance (vertical and horizontal) to groundwater. The influence of this factor would depend on permeability of the vadose zone.
Precipitation	Infiltrating runoff would likely increase the rate of migration of released fuel through the vadose zone to groundwater.
Stability of water table	The potential for hydrocarbons to reach groundwater increases with an increase in water table fluctuation if material overlying an unconfined aquifer contained released pipeline fuel.
Aquifer permeability	Rate of hydrocarbon migration as free product and as a solute plume is reduced with a decrease in permeability.
Aquifer transmissivity	The concentration of dissolved hydrocarbons in a solute plume tends to decrease with an increase in transmissivity
Aquifer connection to surface water	Groundwater that is recharged by surface water containing hydrocarbons would be impacted.

Table D.8-10. Relative Influence of Parameters on Drinking Water Resources Resulting from an Accidental Contaminant Release

Parameter	Influence on Impact
Density of wells	The greater the number of wells producing water from an affected aquifer, the higher the risk that drinking water will become contaminated.
Presence of public water supply well(s)	The number of people supplied by one well is directly related to the number of people that are affected by contaminated groundwater produced from that well. In addition, public water supply wells often pump water from an aquifer at higher rates than individual wells, creating a larger cone of depression (local hydraulic gradient) that could decrease the time of travel for contaminants to reach the well relative to travel time to nearby wells with smaller yields in the same aquifer.
Solubility of contaminant	Contaminant concentrations and rate of flow tend to increase with solubility (a gasoline plume will travel faster than a diesel plume)
Rate of groundwater flow	Time of travel of a contaminant plume increases with decreasing rate of groundwater flow.
Distance between source area and receptor	Contaminant concentrations would decrease, and time of travel, would increase with increased distance from the source area to a well screen.
Aquifer transmissivity	Contaminant concentrations tend to decrease with increasing transmissivity.
Aquifer heterogeneity	An increase in the variability of aquifer characteristics (grain size, chemical composition, gradients) acts to decrease concentrations through dispersive flow.
Water table variations	Fluctuations in the water table can increase concentrations of contaminants and prolong remediation processes by providing a mechanism for hydrocarbons in the unsaturated zone to go into solution with a rising water table.
Aquifer gradient	Decrease in aquifer gradient tends to decrease rate of groundwater migration and contaminant transport.
Chemical composition of aquifer material	The concentration of contaminants in a groundwater plume tends to decrease with an increase in chemical reactions as the plume migrates through aquifer material.
Aquifer permeability	Rate of groundwater migration and contaminant transport tends to increase with increase in aquifer permeability.

ground surface and move downhill as overland flow, and some would seep directly into the ground and migrate vertically to the vadose zone (the unsaturated zone between ground surface and the water table). Vertical flow (downward migration) of fuel in the unsaturated zone would stop when (1) the threshold of residual saturation is reached in soil (occurs when the fuel is adsorbed to soil and rock particles and trapped in capillary spaces); (2) an impermeable layer exists in the path of the fuel; or (3) the fuel reaches the water table.

Petroleum fuel moving through the vadose zone would partition, losing mass as it migrates, and move in four phases: vapor (in soil gas), residual (adsorbed onto soil particles including organic matter), aqueous (dissolved in water), and free or separate (liquid hydrocarbons). The vadose zone often contains organic matter and metal oxides. Contaminants adsorb onto these materials and reduce their rate of movement substantially. If left in place, hydrocarbons adhering to these adsorbents can act as a source of contaminants to groundwater even after remediation has taken place. The thickness of the unsaturated zone (depth to water table) is an important factor that affects how free product migrates and whether hydrocarbons will reach the water table. All things being equal, a greater depth to water table requires a greater volume of released fuel to reach groundwater. The potential for released fuel to reach groundwater is dependent on factors listed in Table D.8-9.

Once free product reaches the water table and begins to accumulate on the capillary fringe (between the water table and the vadose zone where pore spaces are saturated but water pressure is less than atmospheric pressure), individual hydrocarbons will solubilize in groundwater and create a contaminant plume that moves with groundwater gradient. The hydrocarbon plume will move slightly slower than groundwater and concentrations will be greatest near the top of the aquifer. Rate, direction and dispersion of contaminant migration in an aquifer would depend on factors mentioned earlier.

The State Department of Health Services (DHS) has set a maximum contaminant level (MCL) for chemical constituents in drinking water of 1 part per billion (ppb) for benzene, 100 ppb for toluene, 680 ppb for ethylbenzene, and 1,750 ppb for xylene (Cal. Code of Regs., tit. 22, §64444).

The proposed pipeline would transport fuel under pressure, so an accident could result in the initial discharge of large volumes of refined petroleum product. Evaluation of the significance a pipeline accident on groundwater resources requires evaluation of many factors: spill size, estimated frequency of a spill, and potential severity of impacts on the various types of groundwater resources along the proposed and alternative pipeline routes.

The safety analysis presented in Section D.2 indicates that there is a probability that a large product leak or spill of greater than 1,000 barrels would occur during the project lifetime. Mitigation measures are presented in Section D.2 (Pipeline Safety) to enhance SFPP's safety system. However, pipeline leaks and spills are not completely preventable even with state-of-the-art safety measures. Therefore, the potential for a pipeline leak to contaminate groundwater is considered to be significant and not mitigable (Class I).

The extent and severity of contamination would depend on the location of the accident and the density of nearby wells, especially public water supply wells. If groundwater that supplies drinking water wells becomes contaminated, the effects would be severe and of long duration (as evidenced by the SFPP LS 25 spill in the town of Elmira, described above). Mitigation Measures GW-4a, GW-4b, and GW-4c are presented to reduce the severity of this impact. However, since large product spills potentially resulting in discharge of product to groundwater are expected to occur at least once during the lifetime of the pipeline, this impact is classified as significant and unmitigable (Class I).

Mitigation Measures for Impact GW-4: Contamination of groundwater

GW-4a Install Thicker-Wall Pipeline or Weight Coating in Strategic Areas. Where the pipeline is placed within a shallow aquifer, or in an area likely to be disturbed by future construction activity near municipal wells, SFPP shall install a thicker walled pipe, or heavy coating (such as concrete) to the pipeline to mitigate buoyancy in the event the pipeline temporarily does not contain fuel and to provide additional protection from third-party damages. These areas shall be identified by SFPP in a report submitted to the CSLC at least 60 days before construction showing all areas along the approved route with groundwater levels of less than 20 feet.

GW-4b Water Well Protection. During final pipeline design, SFPP shall ensure that the pipeline and all construction activity are located at least 200 feet from any existing water well. Depending on the geology of any particular location, a greater separation or special pipeline design features (e.g., use of thicker-walled pipe to further protect against third-party damage) may be required. In addition, in accordance with California Government Code Sections 51017.1 and 51017.2, if the pipeline is located within 1,000 feet of a public drinking water well, SFPP shall prepare a Pipeline Wellhead Protection Plan that describes SFPP's efforts to ensure pipeline integrity and response measures. A report on water wells, providing the information required in this measure shall be submitted to the State Fire Marshal and the CSLC for review and approval 60 days prior to the start of construction.

GW-4c Groundwater Remediation Procedures. To facilitate effective emergency response to reduce or prevent groundwater contamination before drinking water is impaired, SFPP shall develop emergency response procedures that specifically addresses measures for groundwater remediation in the project area. These procedures shall include the following background information: a description of all wells potentially affected by an accident along the length of the pipeline (including map location, owner contact information, depth of well) and identification of alternative sources of drinking water for all well users that would be potentially affected by a pipeline accident. To prepare for a potential accident, SFPP shall develop an overview of hydrogeologic conditions throughout the length of the pipeline ROW, estimated local aquifer boundaries, groundwater flow directions, locations of stream crossings and probable direction of flow at waterway crossings. SFPP shall also outline applicable remediation approaches for areas potentially affected by a release throughout the length of the pipeline.

Residual Impact. Impact GW-4 is significant even with implementation of Mitigation Measures GW-4a, GW-4b, and GW-4c. **A Statement of Overriding Considerations would be required for project approval.**

D.8.3.5 Impacts of Pipeline Operations

Impact HS-6: Flooding and Erosion Risk During Operation

The proposed pipeline could indirectly cause an increased risk of flooding and erosion (Potentially Significant, Class II)

Impact Discussion

The placement of fill, debris, and above-ground structures (e.g., pipeline control valves) within a stream channel or the floodplain could result in and an increased risk of flooding and erosion. Flooding of above-ground structures could result in damage to the structure and/or water quality degradation.

Mitigation Measure for Impact HS-6: Flooding and Erosion Risk During Operation

HS-6a Floodplain Protection. No structure or permanent fill (including streambed protection devices such as riprap) may be placed within the floodplain of a river or stream unless the structure or fill can be clearly demonstrated by a professional civil engineer to meet the following requirements:

- **It must be essential in that location.**
- **It must be the minimum size necessary to achieve its purpose.**
- **It must be demonstrated to have no adverse flooding or erosion effect on adjacent property.**
- **The natural or existing cross section of a stream may not be permanently altered by installation of above-ground facilities except as allowed under other mitigation measures.**

Valves, stations and other above-ground portions of the pipeline shall be placed outside the 100-year floodplain where possible, or floodproofed by fill or other appropriate means where placement within the floodplain cannot be avoided.

Residual Impact. With implementation of Mitigation Measure HS-6a, impacts from flooding and erosion would be less than significant.

D.8.3.6 Impacts of the Cordelia Mitigation Segment

This mitigation segment was developed to avoid sensitive biological and water resources within Cordelia Marsh and Slough. The 2.6-mile mitigation segment diverges from the proposed route at MP 17.6 and rejoins the proposed route at approximately MP 20.0. The Cordelia Mitigation Segment parallels Ramsey Road, until Cordelia Road, where it continues along Cordelia Road to the UPRR ROW where it rejoins the proposed route (see Figure D.4-3).

Implementation of the Cordelia Mitigation Segment would eliminate the portion of the proposed route that crosses the hydrologically sensitive Cordelia Marsh, but would cross a tributary of the Marsh at Cordelia and Pittman Roads. The marsh area is connected to the Carquinez Strait through tidal flow. The tidal flow and high groundwater level in the marsh area increase the seriousness of potential spills (Impact HS-5) in the area because the spilled product could quickly spread at high tide. In addition, the reroute alignment would eliminate the need to bore under Cordelia Slough, which could cause contamination of the creek in the event of directional drilling fluid seepage (Impact HS-6). The Cordelia Mitigation Segment is preferred over the Proposed Project segment.

D.8.3.7 Impacts of Proposed Station Changes

Construction within the existing Concord and Sacramento Stations could affect surface or groundwater if erosion or runoff of contaminants resulted from construction activities or equipment. Mitigation for erosion control and prevention of construction accidents (HS-1c and HS-2a) should be implemented to ensure that impacts would be less than significant (Class II).

D.8.3.8 Cumulative Impacts

Construction-related impacts of the proposed pipeline are temporary, but would add to the on-going and cumulative disturbance of stream channels and watershed soils by other development characterized by the project list in Table E-1. The primary long-term impact of the Proposed Project is the risk of contamination of surface and groundwater by accidental product spills. None of the cumulative projects are similar in nature to the proposed pipeline. However, there are at least ten new housing projects on the cumulative projects list, as well as a wide range of projects related to the increasing human population in the area. As this population grows, so will the demand for surface and groundwater.

D.8.4 Environmental Impacts and Mitigation Measures for Existing Pipeline ROW Alternative

The Existing Pipeline ROW Alternative would cross approximately 20 major waterways and more than 15 minor watercourses. General impacts and mitigation measures are the same as for the Proposed Project. Approximately 9 miles of the existing pipeline route passes through the low area of the Suisun Slough and associated marsh. Impacts associated with construction and pipeline spills would be particularly severe in this area due to the close proximity of the pipeline to surface and groundwater at most points along this portion of the route. Although the impacts could be mitigated to the same levels of significance as for the Proposed Project, the existing pipeline ROW is a less desirable route as a result of this marsh crossing.

Mitigation Segment EP-1

This segment would reroute the Existing Pipeline ROW Alternative to follow the Proposed Project route in the Cordelia area, rather than following the current route of the existing pipeline through the Suisun Marsh. Because this segment would avoid extensive marshlands and a route much closer to the Carquinez Strait, the mitigation segment is preferred over the original alternative route.

Mitigation Segment EP-2

Mitigation Segment EP-2 would avoid central Davis, moving the route out of railroad ROW and into roadways. There is little difference between the two routes in terms of potential water resources impacts, but a spill near central Davis would have greater impacts than one in the agricultural areas through which the mitigation segment passes. Therefore, Mitigation Segment EP-2 is preferred over the original alternative route.

D.8.5 Environmental Impacts of the No Project Alternative

The No Project Alternative could involve the expansion of the use of the 60-mile SFPP Line Section 25 (Concord–West Sacramento), expansion of SFPP’s existing Line Section 9 (Concord–Stockton–Eastern Sacramento), and the increased use of trucks or trains.

Aside from some minor upgrades of small segments of the existing pipelines, there would be no mitigation measures implemented for the No Project Alternative. Construction impacts (HS-1, HS-2, and HS-3) would be less in magnitude than for the Proposed Project, but impact classification would be potentially significant in the absence of mitigation. Since the existing pipeline is older, burial depths at stream crossings may be shallow and it is possible that it could become exposed by stream action (Impact

HS-4), resulting in a risk to pipeline integrity (Class I with no mitigation). Impact HS-5 would be Class I with probable spill frequency greater than the Proposed Project. The potential for an unanticipated release of drilling fluids to contaminate surface water (Impact HS-6) would depend upon whether directional drilling is used on the small segments to be reconstructed. Overall, the risk of contamination of surface water from the existing pipeline under the No Project Alternative would be a Class I significant impact (Impact HS-7).

The risk of groundwater contamination from product spill would be significantly greater for the No Project Alternative than for the Proposed Project due to higher risk of accident in the older pipelines and result in a Class I impact (Impact GW-6).

Truck and train transportation of product would create the potential for an accident to contaminate surface or groundwater. These are both Class I impacts, but since the risk of accidental spill is greater with truck and train transportation than for a new pipeline, the magnitude of the impact would be greater than for the Proposed Project.

D.8.6 Mitigation Monitoring, Compliance, and Reporting Table

Table F-7 presents the mitigation measures recommended for water resources.